Space Weather Technical Forecast

Issued on Sunday 10 November 2024 at 13:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate solar activity is likely, with a slight chance of X-class flares. Chance of G1 13 Nov.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate during the period, with AR3889 producing an impulsive M4.2 flare at 10/0015 UTC. There are seven sunspot regions on the visible disc. AR3889 in the southeast, is the largest and most complex region. It contains a number of mature spots and has a significant delta configuration in its trailing region. This spot has seen continued growth in penumbra especially around its leading portion, which seems to be the most active part. AR3883, in the southwest, has mature leading and trailing spots, but has seen some decay in the spots occupying the intermediate region, having lost its delta spot on 09 Nov. AR3879 in the northwest is large and mature, though appears stable. The remaining spot regions are smaller and magnetically simple. Low to Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these most probably from AR3889.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE and DSCOVR were indicative of ongoing magnetic cloud and perhaps CH HSS influences. Wind speeds varied between slightly elevated and background, around 360-450 km/s. Density has been highly variable, often above average, with a likely peak of around 22 ppcc measured at 09/2025 UTC. The Interplanetary Magnetic Field (IMF), Bt, was generally Moderate, between 9-13nT. The north-south component, Bz, was mostly southward (negative) directed at Weak to Moderate levels with a minimum around -11nT. Phi angle was generally neutral. Resultant Geomagnetic Activity was generally Unsettled to Active (Kp 3-4), with two G1 Minor Storm (Kp 5) intervals 09/1200-1800UTC.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels throughout. The associated 24-hour fluence was well below the Active threshold, with 1.19e6 integrated flux observed at 10/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast, with a likelihood of isolated M-class flares and a slight chance of X-class flares, most probably from AR3889.

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Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. Slightly Elevated solar wind speeds are considered most likely initially, before the HSS from CH88/+ has a chance of connecting later Day 1 (10 Nov) or Day 2 (11 Nov), perhaps bringing Slightly Elevated to briefly Elevated solar wind speeds. Solar wind speeds expected to trend back towards background levels during Day 3 (12 Nov). An increase in solar winds to 450-500 km/s then likely into Day 4 (13 Nov) with an expected connection to some portion of the large coronal hole CH90/+ currently crossing centre-disk.

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a slight chance of peak G1/Minor Storm conditions, between Days 1-3 (10-12 Nov) due to the risk of minor CME and HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with a chance of G1/Minor Storm conditions upon the connection to CH90/+.

Energetic Particles / Solar Radiation: High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms should we see any significant flares, as the larger regions on the disk rotate into more geoeffective positions in the western hemisphere. The high energy electron flux is expected to remain at generally Background to Moderate levels. The associated fluence is excepted to persist below Active levels.

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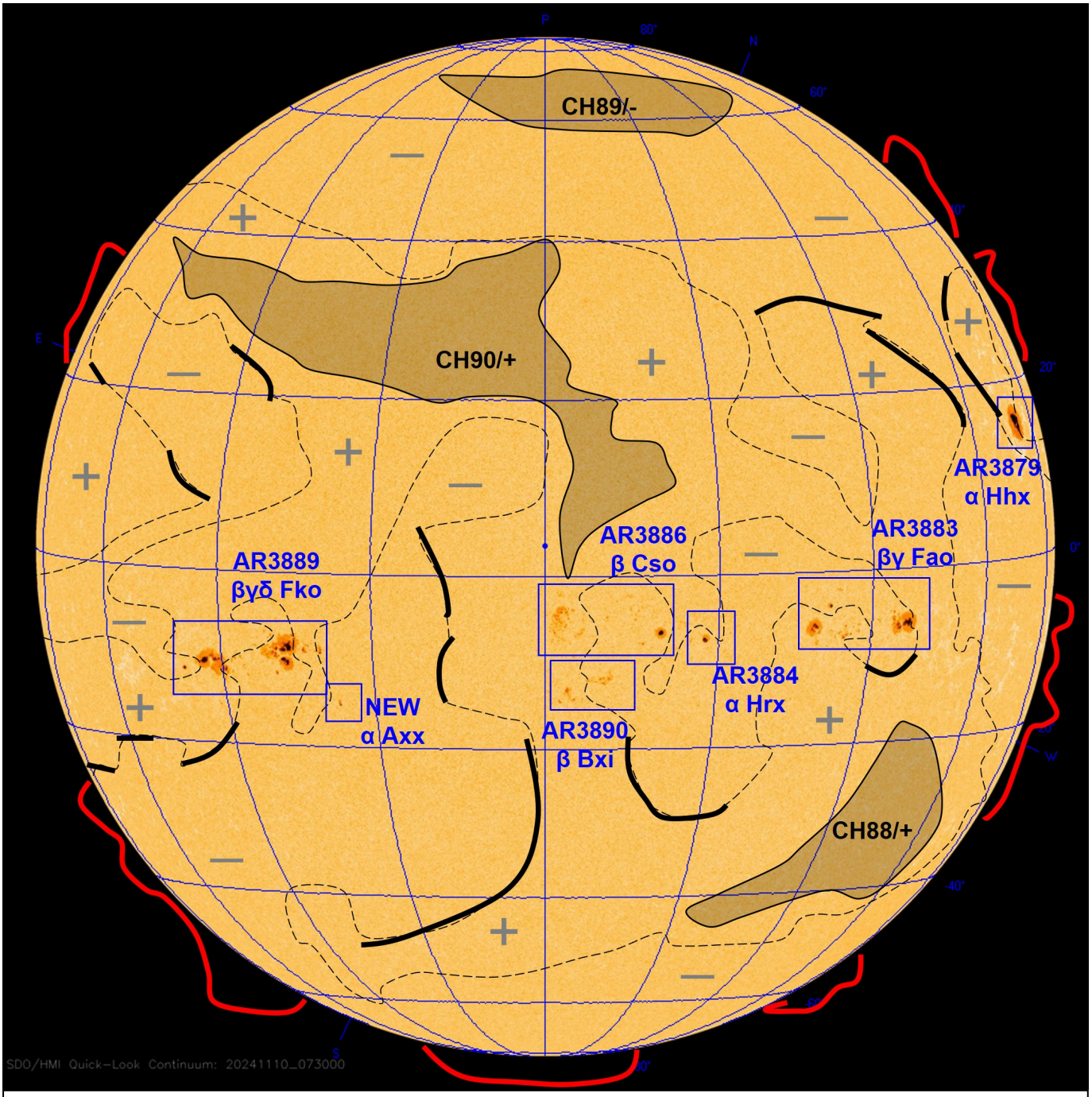
Figure 1: Solar synoptic map valid 10/0730UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth-directed CMEs are currently forecast, however, some weak transients from faint dimmings near centre disk on 08 Nov may arrive during the period.

Solar winds are currently experiencing ongoing CME or coronal hole high speed stream influences. Slightly Elevated solar wind speeds are considered most likely, around 400-450 km/s slowly easing on Day 1 (10 Nov). MOSWOC's ENLIL model shows an ongoing significant enhancement from CH88/+ HSS influence with Strong solar wind speeds. This is considered erroneous with the coronal hole positioned south on the disc with only a limited potential connection expected. If a connection were to occur then this may happen Day 1 (10 Nov) or Day 2 (11 Nov), perhaps bringing Slightly Elevated to briefly Elevated solar wind speeds. Solar wind speeds expected to trend back towards background levels during Day 3 (12 Nov) in the absence of further enhancement. An increase in solar winds to 450-500 km/s then likely into Day 4 (13 Nov) with an expected connection to some portion of the large coronal hole CH90/+ currently crossing centre-disk. This likely bringing Slightly Elevated to Elevated solar wind speeds to end the period.

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a slight chance of peak G1/Minor Storm conditions, between Days 1-3 (10-12 Nov) due to the risk of minor CME and HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with a chance of G1/Minor Storm conditions upon the connection to CH90/+.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	20	20	10	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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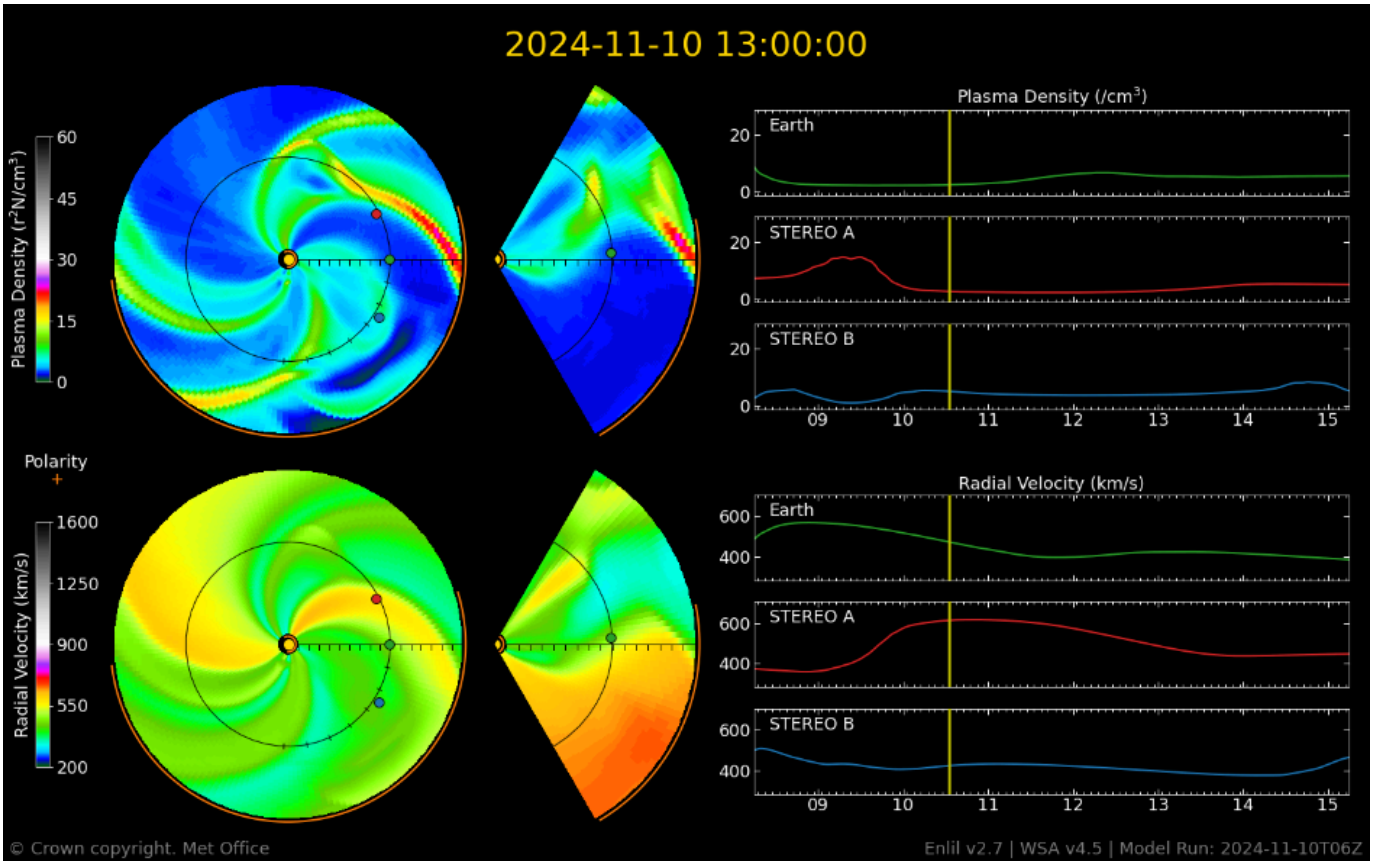
Figure 2:



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Radio Blackouts - X-Ray Flares

Solar activity was Moderate during the period, with AR3889 producing an impulsive M4.2 flare at 10/0015 UTC. There are seven sunspot regions on the visible disc. AR3889 in the southeast, is the largest and most complex region. It contains a number of mature spots and has a significant delta configuration in its trailing region. This spot has seen continued growth in penumbra especially around its leading portion, which seems to be the most active part. AR3883, in the southwest, has mature leading and trailing spots, but has seen some decay in the spots occupying the intermediate region, having lost its delta spot on 09 Nov. AR3879 in the northwest is large and mature, though appears stable. The remaining spot regions are smaller and magnetically simple. Low to Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these most probably from AR3889.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 (M Class)**	Yes	60	60	60	60
Very Active	**R3-R5 (X Class)**	No	20	20	20	20

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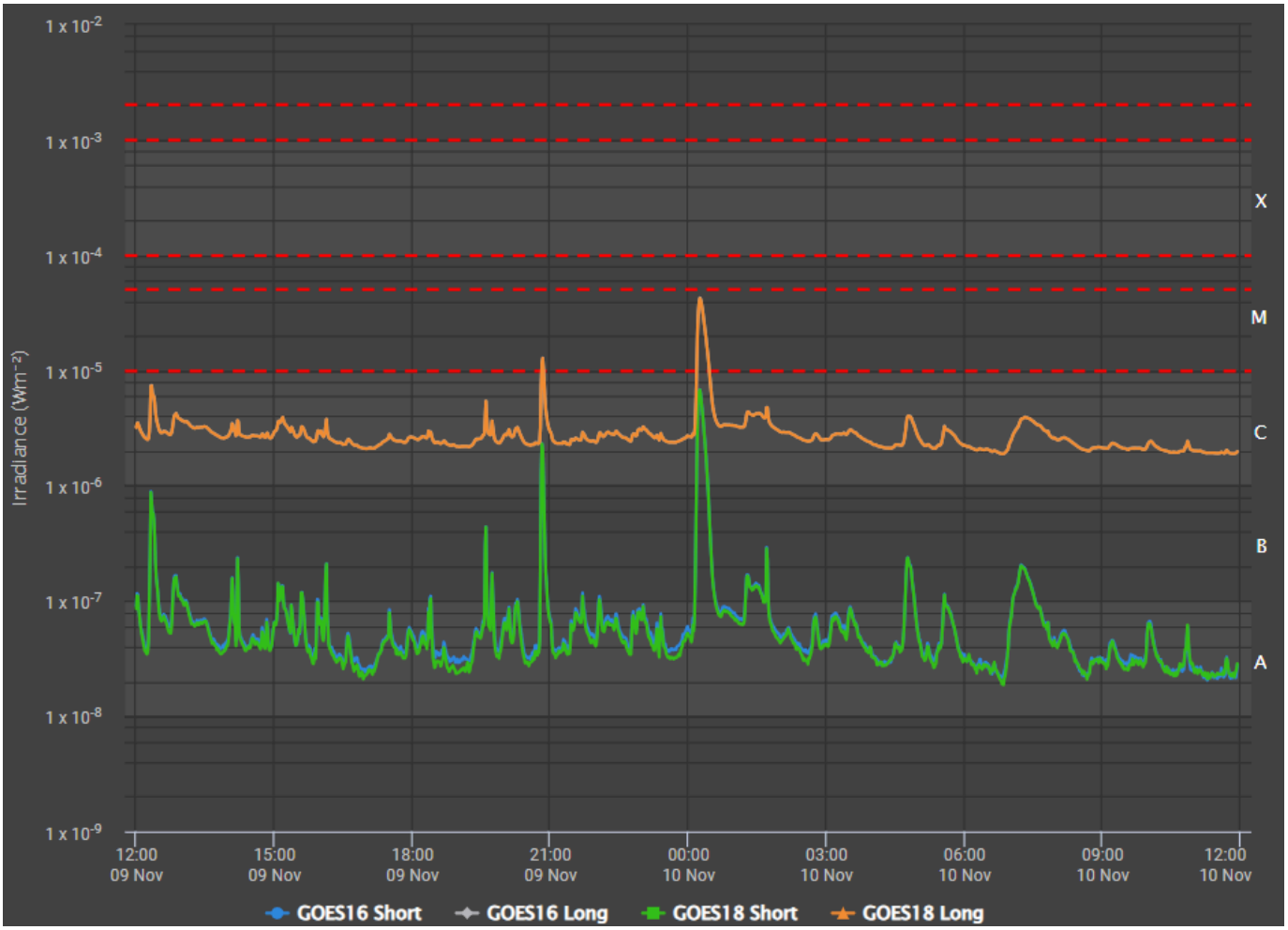
Figure 3: 24 hour X-ray trace



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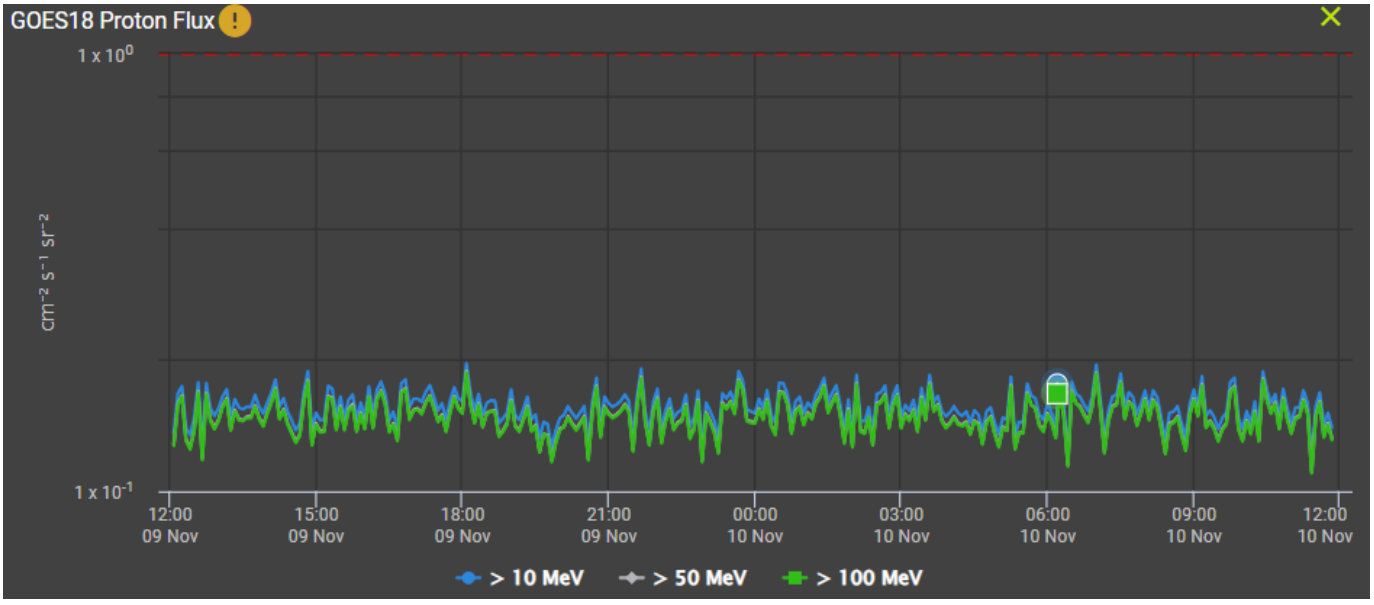
Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms or greater however should we see any significant flares, with the larger regions on the disk rotating into more geoeffective positions in the western hemisphere through the period.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	15	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: 24 hour proton flux



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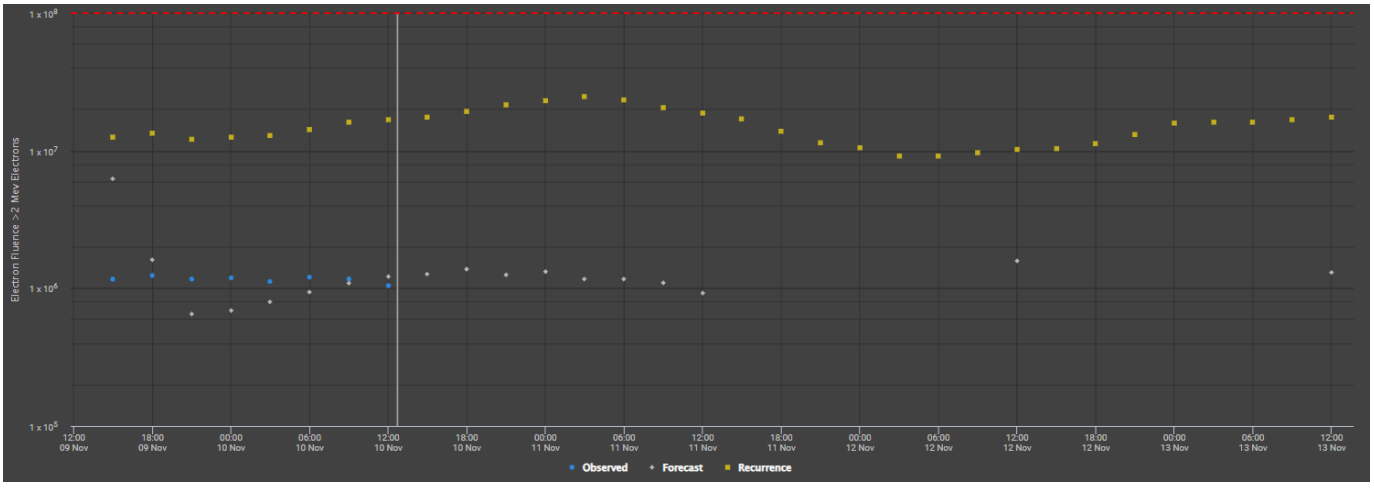
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at Background levels.

The high energy electron flux is expected to remain at generally Background to Moderate levels, potentially increasing to brief High levels at diurnal peak early in the period. The associated 24 hour fluence is expected to persist below Active levels, which corresponds with the guidance shown in MOSWOC REFM output. Therefore the REFM model is considered to be showing reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	5
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: MOSWOC REFM fluence forecast/observations/recurrence



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